

Jet Propulsion Laboratory

National Aeronautics and Space Administration

July 17, 2002

Creating an Opportunity

- ◆ *Knowledge management activities provide the chance to look across an organization, regardless of boundaries, and find opportunities to make a difference...*



- ◆ NASA's Knowledge Management goal
 - Knowledge management is getting the right information to the right people at the right time, and helping people create knowledge and share *and **act** upon information in ways that will measurably improve the performance of an organization and its partners*

Why Is KM Critical to NASA?

- ◆ We are constantly challenged to document and integrate our lessons learned to effectively manage the risk involved in space exploration and human space flight
- ◆ By its nature, NASA's employees have specialized knowledge
- ◆ The workforce in the Agency is aging
- ◆ Our goal is to share knowledge with each other and with the public
- ◆ *The Administration will adopt information technology systems to capture some of the knowledge and skills of retiring employees. Knowledge management systems are just one part of an effective strategy that will help generate, capture, and disseminate knowledge and information that is relevant to the organization's mission.*



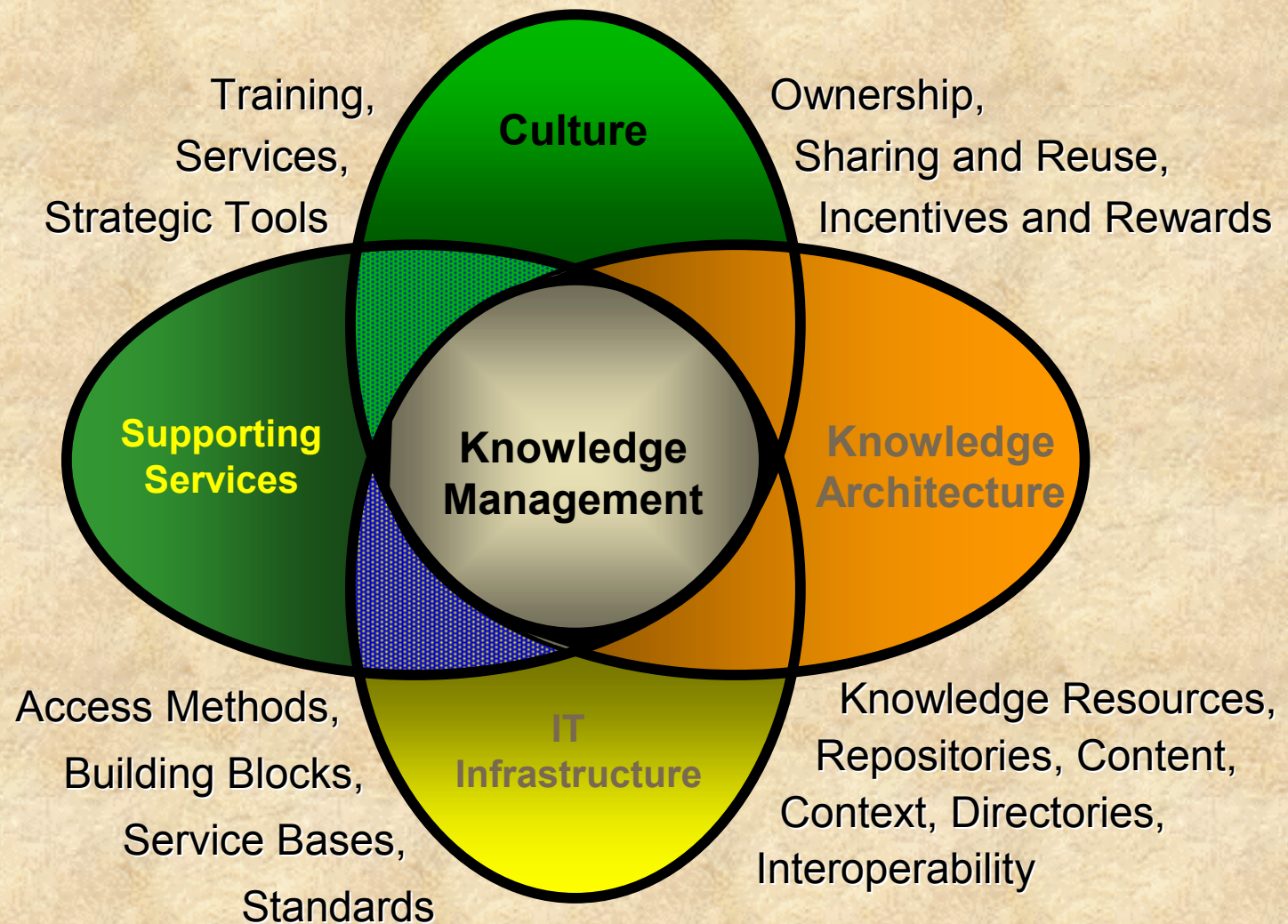
President's Management Agenda

We Began Our Journey Looking Outward...

- ◆ In 1998, we reviewed 43 published case studies and visited 6 organizations to understand what others were doing in KM
 - Standard set of questions, which generally devolved into long conversations
 - Analyzed for critical success factors or reasons implementations failed or stumbled
 - Has held up over the test of time
- ◆ These organizations succeeded at KM when they were
 - Recognizing and rewarding people for sharing knowledge
 - Encouraging and supporting communities of practice
 - Balancing their long-term corporate needs (capturing knowledge) with short-term local needs (completing a task quickly)
- ◆ *Culture* was the most important factor
 - Recognize, reward, and acknowledge the importance of knowledge sharing throughout the organization



KM Critical Success Factors



Building a KM Team

- ◆ We find good solutions, fill the gaps, and build a federation of resources to support our missions and research communities
 - KM supports and enables other processes and initiatives by advocating best practices, promoting good solutions, and building infrastructure and applications to bridge distributed systems
 - KM's goal is to help infuse new ideas or needed technology and to leave or turn over operations to the appropriate content area
- ◆ NASA's Knowledge Management Team is chartered by
 - Chief Information Officer (Lee Holcomb)
 - To embed the rules in the tools
 - Co-sponsored by Chief Engineer and Human Resources
 - To ensure the tools support the engineering processes and to affect cultural change through recognition and education
- ◆ Team members are from across the Agency, ranging from system architects to authors to anthropologists
- ◆ Actively share and benchmark with other Agencies, the National laboratory community, and academia



KM Solutions Help People Find Answers

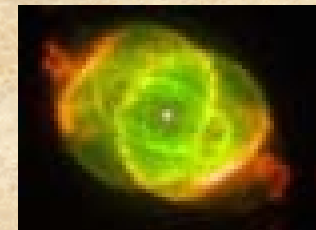
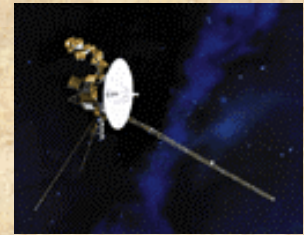


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KM @ NASA

Key Areas for NASA's KM Strategy

- ◆ To sustain NASA's knowledge across missions and generations
 - KM will identify and capture the information that exists across the Agency
- ◆ To help people find, organize, and share the knowledge we already have
 - KM will efficiently manage NASA's knowledge resources
- ◆ To increase collaboration and to facilitate knowledge creation and sharing
 - KM will develop techniques and tools to enable teams and communities to collaborate across the barriers of time and space



Framework for KM at NASA

Sharing and Using Knowledge

| People | Process | Technology |
|---|--|--|
| <ul style="list-style-type: none">• Enable remote collaboration• Support communities of practice• Reward and recognize knowledge sharing• Encourage storytelling | <ul style="list-style-type: none">• Enhance knowledge capture• Manage information | <ul style="list-style-type: none">• Enhance system integration and data mining• Utilize intelligent agents• Exploit expert systems |

Supporting Activities

Education and
Training

IT
Infrastructure

Human
Resources

Security





Making Progress on Knowledge Sharing

- ◆ Providing **training and mentoring**
 - Academy of Program and Project Leadership (APPL) hosts classes, team-targeted training, just-in-time online learning, and a community of practice for project managers
 - <http://appl.nasa.gov>
- ◆ Encouraging **storytelling**
 - Knowledge Sharing Initiative (storytelling) provides forums for people to share stories and publishes the best of those
 - http://appl.nasa.gov/knowledge/knowledge_home.htm
- ◆ **Recognizing people** for sharing knowledge
 - An Human Resource Recognition Management Study is looking at changing our incentives to encourage knowledge sharing
- ◆ Providing access to our **experts**
 - Integrating distributed directories within the Agency and with our partners

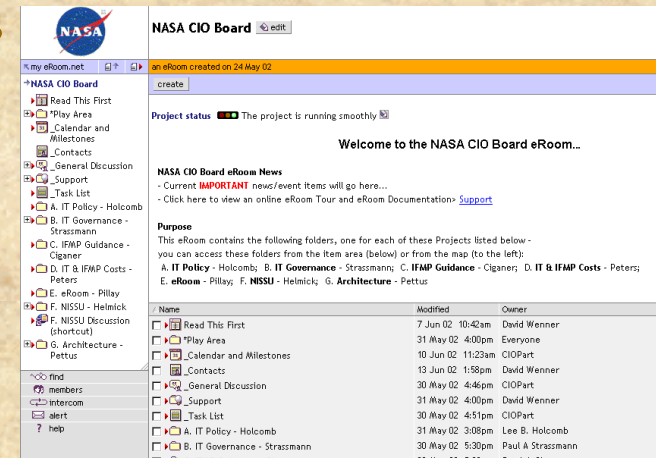
Making Progress (continued)

- ◆ Enhancing our ability to **capture** knowledge
 - Process-Based Mission Assurance collects best practices for managing our risk
 - <http://pbma.hq.nasa.gov/pbmamaster.html>
 - Redesigning our Lessons Learned Information System to encourage sharing of successes and failures
 - <http://llis.nasa.gov>
 - Creating virtual presence of key staff at reviews through our Technical Questions Database
- ◆ Rearchitecting our **web environment** for efficiency and effective communication
 - Content management, web shops, and enabling applications
 - <http://enasa.ksc.nasa.gov>



Deploying Systems and Services in 2002

- ◆ Easing access to information through deployment of cross-cutting information portals
 - For the public, scientists, and employees to streamline access to NASA's 4,000,000 web pages
 - Building the framework for distributed use and publishing processes
 - Creating taxonomies and metadata standards for ease of interoperability
 - <http://km.nasa.gov/portal-white-paper.html>
- ◆ Collaborative environments for missions
 - Creating access to tools and training for virtual teams
 - Quick start team environment
- ◆ Capture design knowledge
 - Creating a service and tools to capture in-process design decisions for use on current and future missions



NASA Portal in Development

See more information at <http://km.nasa.gov>

Sample Portal

INSIDE JPL

DAILY PLANET

JPL RULES!

JPL PUBLIC HOME



Inside JPL

a portal to the JPL intranet

Jet Propulsion Laboratory

California Institute of Technology

Search JPL

[Advanced Search](#) | [Hints](#)

Tuesday, May 21, 2002

Contact the Webmaster

[Report A Problem](#) | [Home](#) | [Content](#) | [Layout](#) | [Help](#) | [Log Out](#)

Page 1

Page 2

User Information

Welcome NASA HQ!
Jeanne Holm
Last Update: [Getting Started](#)
May 21, 2002 1:43:12 PM PDT

Bookmarks

Find a Person

Last Name
First Name

[Boss Phonebook](#)
[NASA X.500 Directory](#)

Google Internet Search


Search the Web

☐ Search WWW ☐ Search nasa.gov

NBS




| Category | Planned | Obligated | Costed |
|----------|---------|-----------|--------|
| 1-Oct | 300 | 300 | 300 |
| 1-Nov | 200 | 200 | 200 |
| 1-Dec | 300 | 300 | 300 |
| YTD | 600 | 600 | 600 |

Real-Time Web Organization Chart Directory Offers Useful Features
Learn how the [features](#) can save you time in your busy schedule.
Find people fast with the [tutorial](#).

Daily Planet

TODAY! NASA Update with Administrator O'Keefe Tuesday
(updated May 21)
NASA Administrator Sean O'Keefe will host another edition of NASA Update Tuesday, May 21, at 10 a.m. JPL staff are invited to von Karman Auditorium, where the program will air live on NASA Television and O'Keefe will answer questions from across all of the agency's field centers.



TODAY! "Project Neptune: Wiring the Juan de Fuca Plate for Science" Tuesday (updated May 21)
TODAY! "Introducing Linux Support" offered (updated May 21)

Headline News - Space.Com

Institutional News from NASA

Today@NASA
[Out of this World Science](#)
May 21st, 2002
[Space Station Systems Operating Smoothly](#)
May 20th, 2002
[Going to Extremes: Parallels in Sea and Space Exploration](#)
May 20th, 2002
[Educator Mission Specialist Morgan Visits DC Schools](#)
May 17th, 2002
["Science in a Box" Heads to Space Station](#)
May 17th, 2002

Directory to JPL Web Space

Labwide Announcements

Labwide Announcements

- [Children and Drugs: Symptoms and Strategies](#) (May 15, 2002)
- [Special Notice-Administrator Names New Deputy AA for ISS and Shuttle](#) (May 14, 2002)
- [Special Notice: NASA Administrator Names New Associate Administrator of Aerospace Technology](#) (May 14, 2002)
- [Bookcase Safe Alert](#) (May 13, 2002)
- [Special Notice: NASA Administrator Selects Chief Engineer](#) (May 13, 2002)
- [Results of 2001 Invention Challenge - Water Balloon Launch Contest](#) (May 13, 2002)

[How to Post Labwide Announcements](#)

Institutional News from JPL

Weather and Traffic

My Calendars

JPL Events Calendar
12:00 PM [Hiking Subclub @ 303-209](#)
[Conference Room](#)
12:00 PM [Project NEPTUNE... @ 167](#)
[Conference Room](#)
[JPL Space Calendar](#)
[NASA Launches](#)

My Project Libraries

ICIS Strategic Planning Knowledge Management Information Technologies & Software Systems

Engineering Links

Science Links

JPL Rules!

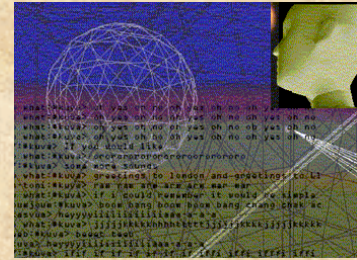
Technical Questions Database

- ◆ Best questions asked at technical reviews
- ◆ Helps to create a virtual presence when key people cannot be there
- ◆ Over 700 questions
- ◆ 42 subject areas



The screenshot shows the JPL Technical Questions Database website. The header features the JPL logo and the title "TECHNICAL QUESTIONS DATABASE". Navigation links for "ADMIN", "HOW TO USE", and "FEEDBACK" are present. The main content area is divided into four sections: "HOT QUESTIONS" (with a red chili pepper icon), "BROWSE" (with a book icon), "SEARCH" (with a magnifying glass icon), and "INPUT" (with a keyboard icon). A detailed description of the database is provided, stating it contains key technical questions for design reviews and acts as a "mind tickler". Below this, a list of links is provided: "Detailed Description" (Format, contents, and organization of the questions and technical discipline areas), "How to Use" (Description of key features of the site and how to use them; Recommendations for how to use the site based on your role (e.g., Cog E)), "Creating Questions and TDAs" (How the existing questions and/ TDAs came to be and the process for updating them), "Related Resources" (Links to related sites and additional resources), and "About this Site" (Key participants, acknowledgements, and background of the Technical Questions Database).

Knowledge Management Roadmap

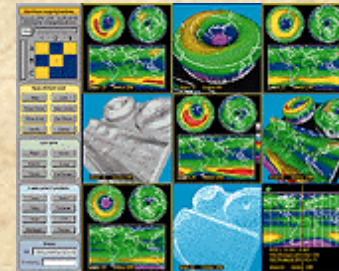


Modeling Expert Knowledge

- Systems model experts' patterns and behaviors to gather knowledge implicitly
- Seamless knowledge exchange with robotic explorers
- Planetary explorers contribute to their successor's design from experience and synthesis
- Knowledge systems collaborate with experts for new research

Enables real-time capture of tacit knowledge from experts on Earth and in permanent outposts

- Interstellar missions
- Permanent colonies



Capturing Knowledge

- Knowledge gathered anywhere from hand-held devices using standard formats on interplanetary Internet
- Expert systems on spacecraft analyze and upload data
- Autonomous agents operate across existing sensor and telemetry products
- Industry and academia supply spacecraft parts based on collaborative designs derived from JPL's knowledge system

Enables capture of knowledge at the point of origin, human or robotic, without invasive technology

- Mars robotic outposts
- Comet Nucleus Sample Return
- Saturn Ring Observer
- Terrestrial Planet Finder



Integrating Distributed Knowledge

- Instrument design is semi-automatic based on knowledge repositories
- Mission software auto-instantiates based on unique mission parameters
- KM principals are part of Lab culture and supported by layered COTS products
- Remote data management allows spacecraft to self-command

Enables seamless integration of systems throughout the world and with robotic spacecraft

- Europa Lander/Submersible
- Titan Organics: Lander/Aerobot
- Neptune Orbiter/Triton Observer



Sharing Knowledge

- Adaptive knowledge infrastructure is in place
- Knowledge resources identified and shared appropriately
- Timely knowledge gets to the right person to make decisions
- Intelligent tools for authoring through archiving
- Cohesive knowledge development between JPL, its partners, and customers

Enables sharing of essential knowledge to complete Agency tasks

- MarsNet
- Europa Orbiter
- Space Interferometry Mission

2003

2007

2010

2025

Sharing Knowledge (2003)

- Adaptive knowledge infrastructure in place
- Knowledge resources identified and shared appropriately
- Timely knowledge gets to the right person to make decisions
- Intelligent tools for authoring through archiving
- Cohesive knowledge development between NASA, its partners, and customers

Enables sharing of essential knowledge to complete Agency tasks

- MarsNet
- Europa Orbiter
- SIM

MarsNet
Europa Orbiter
Space Interferometry

2003

2007

2010

2025



Key Implementation Successes

- ◆ Get executive and/or broad sponsorship to achieve...
 - Cultural change
 - Deployment of systems and solutions
 - Infusion into the day-to-day processes
- ◆ Listen to your customers, and then listen some more
 - Make your first success the most important thing to your customers
- ◆ Keep focused on your long-term objectives, while working on day-to-day implementation
 - Think globally, act locally
- ◆ Become completely integrated to your core business
 - Avoid focusing solely on creating efficiencies
- ◆ Make an implementation choice and follow through
 - Avoid getting caught up in the latest fad
- ◆ Keep true to your vision in the face of adversity

Lessons Learned

- ◆ Enlist, encourage, empower (baptize the evangelists)
- ◆ Develop solutions, services, and rewards
 - Deliver specific solutions to specific customers
 - Build KM into the way people already do their jobs
 - Understand that cultural acceptance is key
 - Make services operational (including funding and metrics)
 - Reward knowledge sharers through promotions, recognition, and time to learn and share
 - Recognize and celebrate contributions of the KM team and others
- ◆ Keep the alliances strong
- ◆ Balance long-term desires (capturing knowledge) with local requirements (specific solutions to a problem)
- ◆ KM solutions are not “one-size-fits-all” and need to be tailored for each organization’s business and culture
- ◆ Don’t try to solve the whole problem—*just start somewhere* and solve part of the problem



Thanks!

- ◆ Many thanks to my colleagues and our partners who contributed to these ideas and to the excellent work they are doing in implementing knowledge management solutions at NASA
- ◆ If you have any additional questions, please contact me
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Jeanne.Holm@jpl.nasa.gov (818) 354-8282
- ◆ More information can be found about
 - NASA's KM program: <http://km.nasa.gov>
 - NASA's Missions: <http://www.nasa.gov>

